Water Technology Meeting – Questions and Comments 4.10.13

Welcome – Jennifer Kofoid

Introduction – Kamyar Guivetchi

Overview – Karl Longley (PPT)

Content Presentations

Data Acquisition: On site/in situ

- Kamyar: Received proposal from UC Merced from the Citrus Group for monitoring at high elevation (Feather River watershed). They are doing some work in conjunction with DWR Flood and Climate. Might be interested in reviewing this part of the talking points. Might have some fairly inexpensive monitoring arrays. Are trying to get people interested in participating tin that array for upper elevations.
- Ned: Is there room in this section for standard water flow meters (water quantity meters)?
- Kamyar: Historically, that has been the purview of USGS – has been reduced by budget cuts, flow quantity.
- David Zoldoske (David): What are the coordination, comunication and trust elements that should be addressed to reduce redundant monitoring efforts? What is the platform for those discussions?
- Kamyar: Would like Water Plan to serve as that platform – using the Water Planning Information Exchange (Water PIE). Are at the proof of concept level. Could discuss under water management section.
- David: In addition to sharing of information, there is the data collection aspect. How and who collects? Discussing data needs and designs – What's the next piece of critical information that we should be collecting?
- Quantity meters for hydrology and end use.
- Mike: Discuss the business sphere: Want to emphasize we need need to help to monetize some of the new development. So that sensors can go forward, more likely if some company decides to pick these up. Example, about 10 years ago – at Scripps, worked with Frank Gehrke at snow survey. Used a new snow-water content sensor that worked by studying the flux of cosmic rays. Came out of Sandia Labs in NM. Could set in the ground by comparing flux near ground surface, compare with results in atmosphere. Fits into a casing about the size of a coffee can. Could replace a snow pillow (12' x 12' envelope containing antifreeze). Can bury this instrument about an inch below the soil surface. About $2,000 - $3,000 for this. Snow pillow costs about $10,000. Sandia has a policy of developing technology to a pilot stage, then license. So there is one company licensed to build these. Needed to tweak it to make it a little less temperature sensitive. Company didn't see a market. Turned it back to Sandia that promptly relicensed it, to a firm that has sat on it for a year. Think about workshops or technology fairs – to draw together those who might produce the instruments. Create forums to stimulate conversations, that might allow new ideas and designs to find their way into the hands of companies that would actually develop. The experience with the cosmic ray detector is the frustration with having the technology in our hands – yet company doesn't see a profit possibility.

- Mike: Isotopes have been used successfully on surface water-groundwater separation and old water and new water interaction.

- Bob: Need to capture idea of hosting a technology fair, perhaps once a year – on how to design and build these sensors inexpensively. There are a lot of people doing creative tinkering.
- Mike: Also raises visibility of issue to those who tinker.
- David: USDA is partnering with industry to develop new technologies. Need to elevate water technology to be part of that conversation.
- Karl: We need to see what the national labs policies are re: sharing of new technologies.
- Kamyar: Could also partner with ACWA conferences in exhibit hall. There are no themes – we could partner with ACWA and provide a little more structure to the technology part of their exhibit hall.

- Jennifer: Originally had tried to set the water technology workshop date to coordinate with the timing of a technology conference.

Technology Categories Table:

- Mike: Costs of isotrophic sensors of groundwater range from $50 to tens of thousands each.

<u>Data Acquisition: Remote Sensing</u>

- Kamyar: There is a lot of existing information from remote sensing that isn't used, analyzed or understood. A program to interpret existing data should be a priority.

Technology Categories Table:

- Dave Asti (Dave): Note on airborne drones for snowpack – Stephanie Granger from JPL had used satellite for snowpack. They have a series of algorithms.

- Mike: Tom Painter, now with JPL, has significant funding from NASA to fly a plane with sensors over snowpack, using LIDAR and hypersensitive spectrals. Recollection is that he'll be doing this for several winters. Uses high-end technology.

- Mike: Perhaps for the limited impact section, Marty Ralph and folks from NOAA Earth Research Lab are working with those in the Sonoma area to implement gap-filling radar – using weather radar to fill in gaps created by topography. NOAA looking at how to do this in a fully operational mode in Sonoma.

- David: Kent, can you speak to the TOPS-SIMS project?
- Kent: This is a web-based application incorporating land-sat images with spatial CIMIS evap-transpiration to determine crop coefficients on a statewide basis. Uses to NDVI to calcuate ground cover. The DWR CIMIS program began with USDA, NASA Ames is now the principal in conjunction with CSU Monterey Bay.
- David: Reason for doing this is that we currently have static data for individual fields to determine irrigation demand.
- Kent: Beyond the individual field basis, are looking at other special boundary basis – to ultimately determine daily crop usage statewide. Ultimately, could include urban landscape.

- Ned: There is some remote sensing for urban landscape. Frank Loge at UC Davis is using video feeds and algorithms to determine fish populations below dams in the northwest.

Data Management

- Dave: Our focus is open MRM and the software has been deployed with the Estuary Portal work group; Metropolitan Water District has created Bay Delta Live; and we're working on San Joaquin River RNT. Created an open-source software that brings in real-time data from CDEC, working with web services from CDEN. On the estuary portal, have been working with agencies to bring in data. Currently, much of the data is on FTP sites. The goal is to get everyone on a web service. Want to move data (such as the 1641 report on Delta water quality report) to a more interactive type of portal system. Could bring in water quality, fish counts, fish tissue, benthic, zooplankton and phytoplankton data to work with data, download and graph some of it. Worked with USGS to web-enable a GR time-series application.

  Started with CDEC since data was available. Working with Jon Burau from USGS, created data visualizations. For example, in the Delta there are 50 turbidity stations. People are concerned with smelt migration being tied to the first flush that comes in. Can move the map, check on turbidity – it pulls and interprets CDEC data for any given time period. It color codes the data. At 12.5 NTUs, the smelt start to migrate – that's where the color starts to change. The estuary portal can look at IEP data back to 1975, then turn on CDEC data. It works as a data sieve. Really increases access time to the data. For the meta-data, best way is to have the data provided through a web service. For the San Joaquin River portal, will create web services into CDEN.

- Karl: Can I obtain diverse data sets, such as snowmelt data? [Yes, you can. Bay Delta Live is a public portal; the Estuary Portal is password protected.] Is this GIS-enabled? [It's map based. Map would create icons that can be rolled over and downloaded per site. Can see a time-series graph, or create point data visualizations. Can also move data into GR graphic time-series app.]

- Dave: Are working with USGS, their raw data is input into CDEC. They clean that data for input into National Water Inventory System. Delta flow stations are on a saved map. Jon Burau clicks the map and data downloads from the 60+ flow stations.

- Mike: Not sure this is a high priority – talking about remote sensing. For data management, there's no way to deal with gridded data in CDEC. Need to manage and communicate that kind of data. CDEC is set up for station data. Satellites cover entire landscapes, producing gridded data.

- Kamyar: Want to share data with all data providers – beyond agencies. There's some overlap with data collection, might want to tease that out. Water PIE as another example of web service information exchange. For making data available for models – UC Davis proposal for Hobbes, is trying to reach the data management platform part (of analytical data process) first (rather than starting with a model algorithm). Most efforts pick a model first, then data management fits the model. HOBBES takes a more global perspective to create data standards, systems and automatic networks generators – and make that data available for those who want to use different models and algorithms with that data. Creates some partnership opportunities.

- Ned: For end use, CPUC is working right now on an energy-data exchange using utility data that is aggregated so that the public and researchers can use it. Looking at what of level of aggregation that is needed – need enough to provide anonymity while providing enough granularity for next level analysis. This question applies to aggregating water use data also for water use across the state.

- Jennifer: Planning timeframe of 5-10 years. Data management integration is a slow process.
- Karl: 5-10 years is about as good as we can come up with. Might be 2 or 20 years.
- Kamyar: When it comes to data, certainly funding is always a factor in expediency. It's more about people. There are ownership access factors and apprehension on sharing data and how it might be used. It's more about a social-political conversation to get people to share data.
- Karl: Example of that is difficulty in obtaining water levels.
- Ned: Ongoing maintenance is another challenge.
- Jennifer: Getting providers on web service alone is a challenge.
- Dave: The Estuary was a good effort to test this out and bring different data together. It was for a specific region and for a specific task. People were willing to contribute to that.
- Kamyar: If CPUC is successful in managing privacy – that's a big part. Differential access to different data greatly complicates the system, when trying to provide protections.
- David: There are national security issues as well with some data sets.
- Kamyar: This should include a social science aspect, more than IT alone.
- Dave: Will have poster session at IEP (Interagency Ecological Program) on April 25 in Natomas.

<u>Water Treatment – Membranes</u>

- Kamyar: Does water treatment include wastewater treatment? [Yes] Might want to clarify. Yesterday, the DAC/EJ Caucus discussed the rural nature of small systems. Under the priorities – this is not strictly a technology issue – need to look at the fact that addressing small system problems is not cost-effective. Are trying to apply mainstream technology solutions. For example, regionalization includes a lot of piping and infrastructure. Decentralized, in-situ water treatment technologies could really help address rural, small system problems in California.
- Karl: For small systems, the major costs are O & M. Consolidated systems are not necessarily connected by pipes. We spent a lot of time thinking about distributed treatment technology – and evolved into a discussion on smart control systems. This technology could be applied to any water treatment technology. We can operate these systems effectively, reducing O & M costs. Being used in New Mexico, even though NM doesn't make the use of sensors that they could. The issue of disinfectant by-products is that they will grow in the distribution system. Want to check with larger systems to see how they handle this (which isn't being done very effectively).
- Bob: There is an important point here. To broaden thinking about technology at different scales – want to focus on this a bit. Provide a comment on scalability and opportunities to address some of these issues.
- Karl: Smart water systems address that – can use in any size plant or system. It requires more sensor development.
- Kamyar: For the write-up on priorities, rather than getting into details, flag the need for R & D and commercialization around distributive systems and mobile systems for water and wastewater treatment (which would help rural and disadvantaged communities). Improved mobile systems could be effective in disasters. Over the last 20 years, in large part due to the military, there are mobile desal units that can fit on a ship to fitting in a pick-up truck.
- Ned: Broadened deployment of desal is maybe not the goal. Resiliency is the goal. Desal can be very energy intensive.

- Kamyar: Desal is both ocean and brackish. Brackish desal through membranes is very effective.
- Karl: Membrane technology removes more constituents than salts.

Technology Categories Table: (third bullet, renewable energy use)

- Kamyar: There is a company is working with Coca-Cola on small systems in Africa and South America – using heat exchangers (recycled energy) to reportedly provide drinking water for up to 100 people using the amount of energy needed for a toaster oven. Partnering with Coca-Cola, whose distributions systems provide O & M opportunities to change filters and maintain.
- Karl: Another company, that works with DoD and is in Africa also, uses solar sources for R/O.
- Ned: Off-grid locations are good candidates for solar or recycled energy sources.
- David: Treating to intended use may fit in this, or next, box. (Point-of-use treatment.)

<u>Water Treatment – Chemical/Biological</u>

- Feasibiity v. what's approved for use in field; engineered wetlands (potential barrier with update of aquatic organisms).
- Kamyar: The second bullet also applies to non-membrane technology.
- David: This was an attempt to call out high-tech v. low-tech
- Kamyar: More and more, membrane is becoming low-tech.
- David: O & M was another consideration for breaking out these categories.
- KG: In addition to engineered wetlands, restored meadows are recognized as an important treatment.
- Ned: Flag that treatment technologies apply to all sources of water (storm, rain, etc.)

Technology Categories Table:

- Karl: Add meadows to constructed meadows. Here's the problem with buckets – systems operations need as much good data as possible.
- Denitirification processes for groundwater - Jus Brown is the researcher for remediating contaminated groundwater. Removing nitrification and arsenic for groundwater remediation.

<u>Watershed Management</u>

- Karl: This is a different type of bucket. Comes back to meadows. Better models and data are needed for decision-making. Better use of floodplain, recharge sites (policy issue).
- Kamyar: Are there opportunities to improve well-injection technology. The timing of groundwater recharge is an issue.
- Kamyar: ACWA adopted policy principles for improving headwaters; there is a research section.
- Ned: Ability to combine applicable models. The Stockholm Environment Institute has been working to link WEAP and LEAP, which allows you to ask more interesting questions. For example, how changing the energy technology portfolio might increase or decrease the available water resources.

Technology Categories Table:

- Kamyar: Electrical companies could be a part of last item, and private land owners as private sector **<u>entities</u>**.

Ag WUE

- David: Some of this looks forward, not just to tools for managing, but looks at actual ag water (specific on-farm applications, data collection – same tools allow both). Aggregate in a way that supports better decisions, yet is not farm-specific.
- Karl: Regarding, what about water meters. (First bullet is water measurement)
- Kamyar: Ag water management is very dependent on crop and location. Can't use the same meter and plug it into any agricultural operation. Technology might be able to reduce the costs of measuring water in different ag settings. The State specified accuracy standards, rather than a specific technology – which leaves a lot of room for different approaches.
- David: Observations about multiple uses of water. What is reuse of water? There is intentional and indirect reuse. Understand 3rd party impacts – this needs to be considered when moving water around (e.g. on-farm v. basin-wide efficiency).
- Bob: Is there a way to say this in a more value-neutral way? There can be both positive and negative impacts. Where do you get multiple benefits? This can stimulate thinking about where you get a string of benefits. Efficiencies in ET or reducing discharges to sinks create benefits.
- Ned: Taking a systems perspective to look at positive and negative externalities.

Technology Categories Table:

- Add land fallowing or retirement to last bullet.
- Kamyar: With implementation of SBx7-7, the ag stakeholder committee had good conversations. One apect was how to measure the economic efficiency of ag activities (more than price to determine economic activity). Tools or methods are needed for farmers to evaluate economic aspects of their decisions, as well as water use. The stakeholder also discussed methods and metrics for ag water use. Much data isn't available to create metrics. New ways are needed to help farmers measure efficiency of water use. (Might want to look at the report on topic that would provide value to growers.)
- Kamyar: Need data collection or analytical approaches.
- David: Then reporting in a manner that growers can use.

Urban WUE

- Kamyar: On urban side, the SBx7-7 work, identified the data gap regarding amount of landscape and types of vegetation for urban landscapes. Most entities don't have a sense of the area involved and potential water use (acreage and vegetation).
- Ned: Improved data and information for behavior change. OPOWR translates the water bill for water use. There was a 2% - 5% water savings based only on education.
- David: Need to translate a single metric to other elements (tree shade and energy offset, lawns and carbon sequestration).
- Ned: The City of Davis revamped their rate structure. Creates more of a price signal for conservation. The fixed price of water is a larger part of the bill, based on previous use, resulting in less of a signal from variable use; this reduces revenue loss (resulting from conservation) to the utility.

- Karl: Would like to use this as an example. Represents more of a policy discussion. Technology deployment might be a policy issue.
- Kamyar: Report will inform policy discussions. The topic of rate structures includes both policy and data aspects. End users are vexed when they save water and bills increase. Perhaps add a bullet to look at urban income to decouple from revenue generation from water conservation – how to build that into the rate structure.
- Ned: The State is moving towards (embedded) energy rebates for water conservation
- Karl: Exploring better technologies for leak detection (and repair). Developing strategic access to system for repairs.

Technology Categories Table:

- For second category: add stormwater and rainwater capture.
- David: Improve technology for in-house use of point-of-use and point-of-entry treatment. Karl: There are strong applications and research opportunities.
- Kamyar: This might fit in the "promising but limited" category.
- Karl: The problem with point-of-use is likelihood of undetected failures, which creates a public health issue. Smart systems need to be in place, although these can fail as well. On a wide-spread basis, you can't determine water quality with point-of-use systems.

<u>Water-Energy Nexus</u>

Bullet #1

- Bob: Disconnect the use of renewables from any particular application. Both smart grid technology and renewables are important. Power into the system and the use of renewables is separate from supplying water and the best way to do that. Disaggregate those two.
- Jude: We are currently limited in the amount of renewables that we can use. If it can go above a certain level, then can take the water consumption of fossil fuel generation off the table. (Bob: I can see that. Let's clarify that.) Here we're talking about a smart electrical grid – that puts more of the interruptable load in the base. Then reduce the about of water needed for cooling needed to produce power from gas or coal. Will work to make that clearer – break into two pieces. Also, this is <u>starting to be</u> deployed on the electrical side.

Bullets #2-4

- Relates more to membranes; don't deliver water pressure at higher pressures than needed.
- Bob: Pressure management and system management ties to in-conduit hydro, where they are using constrictors and throwing that energy away. (Bullets 2 & 3 tie together)
- Bob: Another consideration – so much potential is from increasing WUE and shifting water sources (making reclaimed water available v. ocean desal or inter-basin transfers). Need to account for energy benefits that accrue from increased WUE and source shifting.
- Kamyar: How to make more efficient use of water in energy production – this is a separate issue on the flip side of the equation – moving to no- or low-water cooling processes.
- Bob: Solar thermal technologies are water intensive, with very high water consumption profile.
- Ned: Look at the where and when of pump use, to reduce congestion on the grid at peak times.

Technology Categories Table:

- David: Make last bullet about energy harvesting from both supply and wastewater.

Discussion of Categories

- Kamyar: The first five buckets looked at specific aspects of technologies; from bucket 6 on, the discussion was around specific applications. There is some thematic overlap.
- Karl: Ways to sort - technology v. applications; research v. policy
- Ned: Perhaps have "applications" as a column (e.g. WUE, watershed management), and rows would be software (data and analytics) and hardware components (technologies, such as membranes or something like that). Both of these cut across the applications. Might want another row that links to policy or policy innovations.
- Kamyar: Would offer that innovation also extends to communication, outreach and education.
- Dave: Done correctly, data collection and analytics visualization is part of education and outreach.
- Kamyar: The term "Information technology" covers data acquisition, data management, analytics. Would be good to separate this out from tool and model development.

Agents of change

- Kamyar: When I hear that, I think of governance – which is related and could be aprt of the discussion. Governance gets into policy (either a data "czar" or a distributed system). This is will be controversial and shift the conversation away from the actual technology. The Water Plan has governance as part of the larger context. It might be better to make sure that the technology discussion doesn't get bogged down.
- Karl and David: Agents of change – who takes responsibility, provides leadership? Develop a list of stakeholders who are responsible, identifying types of entities.
- Kamyar: Want to provide a roadmap that people can use when they choose to take action. The task becomes encouraging those with resources to step up and use this roadmap.
- David: Need a feedback loop of what agents of change are doing and when; provide an ongoing assessment of activities and reporting out.
- Kamyar: Might want to offer or suggest performance metrics (report card) regarding the adoption of science and technology. How do you measure it?

- Jude and Bob: Need to focus on technologies, **the buckets and the table**. Is this the right format to assess the technologies, can it be improved? Is this the best way to package the information?
- David: Combine technologies into one bucket. And add another table with application column.
- Mike: The application for the Atmospheric River Network took a long view of the network using a tiered system with four levels: (Kamyar can distribute the report)
    - Why aren't we doing this already? (Wasn't possible a few years back, is now)
    - Current technologies (possible but expensive)
    - Future technologies (promising) – e.g. within reach
    - Future technologies (still developing) – e.g. not within reach (expense or development)
- Kamyar: Factors seem to be current v. future; cost effective; importance/impact.
- Ned: Likely impact seems related to level of scope (nature and importance of problem), scale (technology: replication and distribution), and cost. Might want to check those boxes.

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Participants

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